

LUMINAIRE REFLECTORFIELD OF THE INVENTION

This invention relates generally to luminaire reflectors and more particularly to luminaire reflectors used for a wide variety of lighting applications.

10 BACKGROUND OF THE INVENTION

Many luminaires incorporate reflectors to increase the efficiency of their light output. Reflectors can be formed in a variety of shapes and sizes and are typically designed and oriented to provide optimized light distribution for particular applications. Accordingly, they may be symmetrical or asymmetrical depending on the desired light output distribution. The most 15 common reflector for a luminaire is a symmetrical reflector. Because the reflector surrounds the lamp to reflect the light, it is usually fashioned from a single piece of material or is fashioned from multiple pieces of material to constitute a single reflector.

As mentioned, a standard reflector for a luminaire is a symmetrical design. The reflector surrounds the lamp and reflects the light downward in a substantially round distribution pattern. 20 Because the lamp is almost always placed within the volume defined by the reflector, the wide angle illumination of a lamp and reflector combination is limited to the light that is directly emitted from the lamp and/or is reflected by the reflector and then passes below the edge of the reflector or luminaire body without contacting any part of the luminaire. This limitation results in a relatively limited wide angle light distribution pattern below the luminaire. To an extent, 25 this difficulty can be addressed by lowering the lamp within the reflector volume or raising the reflector with respect to the lamp. However, this can result in increased glare and eye strain. Additionally, in having a reflector that surrounds the lamp some of the light is reflected multiple

5 times within the reflector thereby reducing the efficiency of the luminaire. Further, some of the light is reflected back through the lamp itself which can result in reduced lamp life and reduced efficiency.

While other reflectors have been designed specifically to provide wide angle lighting distribution patterns, they are subject to different design considerations and usually result in 10 decreased light intensity in certain regions in order to maximize the light intensity in other desired areas. While this provides an improved luminaire for specific lighting applications, such luminaires have limited utility for other lighting applications.

Thus, there is a substantial need for a reflector that can increase luminaire efficiency while providing increased wide angle lighting.

15 **SUMMARY OF THE INVENTION**

The present invention is a reflector that provides increased wide angle lighting over standard and specialized luminaires through the use of individual reflector elements that do not physically enclose the lamp but are disposed around the lamp. More specifically, the reflector elements are of such shape and location that substantially none of the light reflected by any 20 reflector element is reflected back toward the center of the luminaire; instead all of the reflected light is reflected away from the luminaire as part of a wide angle distribution pattern.

In the preferred embodiment, the luminaire has four identical reflectors symmetrically disposed around a central lamp. The cross-sections of the reflectors are curves and are shaped so that all of the reflected light is reflected at substantially the same wide angle. Accordingly, the 25 light that is not reflected illuminates the area below the luminaire while the reflected light solely illuminates outlying areas at the designated wide angle. Together, the illumination patterns in the preferred embodiment are designed to create a substantially round pattern. In the preferred

5 embodiment the wide angle is seventy degrees from nadir, thereby cutting off further wide angle illumination to prevent glare and eye strain and reducing the number of poles and fixtures otherwise required. In its preferred embodiment the reflectors are comprised of curves that are generally parabolic along the vertical plane and are generally elliptical along the horizontal plane.

10 The shape of the reflectors can be changed to alter the angle at which light is reflected. The reflectors could also be asymmetrically disposed around the lamp to create a non-uniform illumination pattern. Also, if desired, a lens could be used beneath and/or around the lamp and reflectors to focus the emitted light and/or protect the lamp and reflectors. In the preferred embodiment a 400 watt metal halide high intensity discharge (HID) lamp is used, but other types 15 of lamp could be substituted in its place for different applications. For HID lamps, external control equipment is commonly used and is stored within a ballast box located within the luminaire or remotely mounted, and electrically connected to the luminaire. The reflectors can be formed by a variety of methods used to form reflectors including but not limited to using a sheet metal hydroform press, a plastic injection molding and vapor deposition process, a die cast 20 for zinc or rapid tooling technologies.

By virtue of the foregoing, there is thus provided a luminaire that provides increased angle illumination with fewer luminaires required to illuminate an area. Additionally, the design of the reflectors provides increased efficiency over standard luminaires as the result of the minimized internal reflections, thereby providing greater illumination and permitting the use of 25 lower wattage lamps for equivalent levels of light, thereby reducing usage of electricity while preserving usable light output. These and other objects and advantages of the present invention shall become apparent from the accompanying drawings and the detailed description thereof.

5 BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with a general description of the invention given above, and the detailed description given below, serve to explain the principles of the invention.

10 FIG. 1 is an elevation perspective of the reflectors and lamp of the preferred embodiment in accordance with the principles of the present invention.

FIG. 2 is a detailed side perspective of the reflectors and lamp of the preferred embodiment.

15 FIG. 3 is a detailed top perspective of the reflectors and lamp of the preferred embodiment.

FIGS. 4A and 4B are elevated and side perspectives, respectively, of the preferred embodiment of the luminaire.

FIG. 5 is a diagram showing the light reflection pattern from one of the reflectors for the preferred embodiment of the luminaire.

20 FIG. 6 is a diagram showing the light distribution pattern for the preferred embodiment of the luminaire.

FIG. 7 is a perspective of a single reflector blade of the preferred embodiment.

FIG. 8 is a diagram showing specific curves corresponding to cross-sections of the reflector blade represented in FIG. 7.

25 DETAILED DESCRIPTION OF THE DRAWINGS

The luminaire 10, as depicted in FIGS. 1, 2 and 3, comprises a lamp 12 surrounded by four reflectors 14. The four reflectors 14 shown in the preferred embodiment are separate

5 elements that are sections of curves that are generally parabolically shaped in the vertical plane and generally elliptically shaped in the horizontal plane. The reflectors 14 are symmetrically oriented around the lamp such that all of the light output that is not initially directed below the bottom edges of the reflectors is reflected from the reflectors 14 at a generally single angle. In the preferred embodiment, the dimensions from the furthest outside point of one reflector to the
10 furthest outside point of the reflector that is opposite such first reflector is fifteen inches and the height of each reflector is approximately eleven inches.

The reflectors 14 can be secured in position by a variety of methods. FIGS. 4A and 4B show the reflectors 14 being held in place by sitting on top of the lens 16 and centered around lamp 12 inside of the lens or luminaire body 18. Examples of other ways the reflectors could
15 also be held in place include joining them to an overhead frame via fastening means, by attaching them to a frame via fastening means, attaching them directly to the lens with adhesive means, using wire form rings attached to an overhead frame, using a single wire form ring on a neutral axis of the reflectors or other fastening means.

The light reflection pattern 20 is depicted in FIG. 5. A first reflector 14a and second
20 reflector 14b are shown with a light reflection pattern 20 being shown from the first reflector 14a. The light reflected from the inner portion of the first reflector 14a passes near the end of the reflector 14a and light reflected from the outer portion of the reflector 14a passes near the back of the second reflector 14b, however, substantially none of the reflected light is reflected again by either the first reflector 14a or the second reflector 14b.

25 The photometric report for the preferred luminaire is shown in FIG. 6. In this particular report the luminaire 10 was mounted at a height of twenty feet and this report shows the horizontal illumination on the ground. Qualitatively, the preferred embodiment of the luminaire

5 10 produces a widespread, substantially round light pattern. The light intensity distribution could easily be modified by adjusting either the shape, size, position and/or number of the reflectors 14.

FIGS. 7 and 8 show the specific curves that comprise a single reflector 14 in the preferred embodiment of the luminaire 10. The lamp 12 is represented as a single point referred to as the
10 light center. The curves x1, x2 and x3 in the horizontal plane and curves y1, y2 and y3 in the vertical plane are shown as part of the reflector in FIG. 7 and shown as individual curves in FIG. 8. Curves y2 and y3 each are comprised of three different generally parabolic shapes 30, 31 and 32 and curve y1 is comprised of two generally parabolic segments 30 and 31.

While the present invention has been illustrated by description of an embodiment which
15 has been described in detail, it is not the intention of the applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages will readily appear to those skilled in the art. Thus, the invention in its broadest aspects is not limited to the specific details, representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from the details without departing from the spirit or scope
20 of applicant's general inventive concept.